

A REVISION OF THE FOSSIL PLANTS OF THE GENUS
NAGEIOPSIS OF FONTAINE.

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In the elaboration of the Potomac flora of Maryland for the proposed monograph of the Maryland Geological Survey it has been found necessary to reexamine all of the Virginia material and in many cases to recast certain of the larger genera where the limits have been found to be vague. That the multiplication of species in the past has been much greater than the facts warranted has long been suspected, and several writers, notably Seward, have voiced this view. A careful study only serves to emphasize this opinion, and it is proposed to publish several of these systematic revisions as fast as they are prepared, since the proposed monograph deals mainly with species known to occur in Maryland. Furthermore, the Patuxent formation, the basal member of the Potomac group, is extremely deficient in plant remains in the Maryland area, while a representative flora is present at this horizon in Virginia, so that generic revisions lack balance unless the full data which form the foundation of the new interpretations are given.

The writer has had the advantage of studying at one time all of the specimens collected by Fontaine, Ward, Bibbins, and others, and this method has served to disclose certain errors of identification which resulted from the method of the former, who worked over a long period of years upon collections from a large number of localities and without the various types at hand for comparison. The writer is under obligations to the U. S. National Museum, where all of the Potomac types are lodged, for many courtesies, and he also gratefully acknowledges the constant advice and criticism of Dr. F. H. Knowlton.

The first genus to be considered is *Nageiopsis*, which was founded by Fontaine in 1890, for forms apparently allied to the modern species which make up the *Nageia* section of the genus *Podocarpus*. He characterizes *Nageiopsis* as follows:

Trees or shrubs with leaves and branches spreading in one plane; leaves varying much in size and shape, those toward the base of the twigs sometimes smaller than those higher up, distichous mostly, or rarely subdistichous, opposite and persistent.

attached by a short slightly twisted footstalk, usually to the side of the twig, more rarely slightly within the margin on the upper or under surface of the stem, either attenuated toward the base or abruptly rounded off there, at their ends acute or subacute; nerves several, coalescing at base to form a footstalk, forking immediately at the base or a short distance above, then approximately parallel to near the tips of the leaves, where they are somewhat crowded together, but do not converge to a union, ending in or near the extremity.

The diagnostic characters which deserve emphasis are the branching habit, the persistent leaves, and the parallel veins which do not converge to any great extent in the apex of the leaf. These all serve to distinguish the species of *Nageiopsis* from the cycadaceous fronds or leaflets, with which they are most likely to be confused. The genus *Podozamites*, for example, which is supposed to be Cycadean, although Seward suggests that it may be Araucarian, is very similar in appearance, so similar in fact that Professor Fontaine included a number of *Podozamites* leaflets in his various species of *Nageiopsis*. But *Podozamites* is usually represented by detached leaves, hence it was deciduous in habit; the fronds are not known to branch, and this is not only a distinguishing character but an argument against an Araucarian affinity; finally, the veins converge, more or less, apically.

Throughout the whole order Coniferales the phyllotaxy is as a rule spiral, more rarely it is cyclic in character. A true distichous or two ranked arrangement is unknown, although a great many conifers with a spiral phyllotaxy are markedly distichous in habit, as for example, *Taxodium*, *Araucaria*, *Tunioa*, *Taxus*, etc. It seems probable that *Nageiopsis* was no exception to the general rule; in fact some specimens show leaves inserted on all four sides of the stem. More often, however, the exact method of attachment is obscured, but the more or less twisted base argues strongly for a spiral phyllotaxy. A distichous habit is strongly emphasized in fossil impressions which have been subjected to more or less compression, just as it is in the case of pressed herbarium specimens.

There is a suggestion in some specimens of *Nageiopsis* that the base was markedly decurrent as in the modern *Araucaria bidwilli*. This is furnished by the extraordinarily large size of some of the stems, which are irregularly expanded and contracted as if certain of the decurrent leaf bases had been spread out somewhat in the flattening which accompanied fossilization. This feature is especially well shown in the portion of the specimen of *Nageiopsis zamioides* figured (fig. 1). The stem is broad at the base, giving off on either side subopposite leaves with apparently sheathing decurrent bases. Above their insertion the stem is considerably narrowed, passing to a portion obscurely preserved. Above this point it is at least twice as broad, contracting to form the narrow base of the right-hand leaf, while just above the main stem is continued as a much narrowed

twig, the next leaf above, that on the left, having its base concealed behind the twig. In no instance is the preservation as good as could be desired, so that the question can not be definitely settled, but such examples as that figured go a long way toward proving that at least some of the forms referred to *Nageiopsis* had strongly decurrent leaves and a spiral phyllotaxy. Similar features are shown in some of the specimens of *Nageiopsis angustifolia* and are indicated in the latest published figures of this species.^a

Fourteen supposed species have been described from the Potomac group, an additional one from the Kootanie, and Professor Seward recognizes a species in the English Wealden and doubtfully records a representative from the inferior Oolite of Yorkshire. The genus is also possibly represented in the Neocomian of Japan by specimens which have been identified as *Podozamites*, but this is far from being demonstrable.

The Potomac species, excluding those fragmentary species which are not here recognized as related to *Nageiopsis*, fall naturally into three species characterized, respectively, by the possession of very long linear leaves, very narrow lanceolate leaves and ovate-lanceolate leaves and ovate-lanceolate leaves.

They are especially characteristic of the Patuxent formation, in fact the bulk of the unequivocal material comes from the single locality at Fredericksburg, Virginia. They evidently survived the close of the Patuxent, however, characteristic specimens of *Nageiopsis angustifolia* occurring in the lower beds at Federal Hill in Maryland, and at various Patapasco outcrops in Virginia.

Regarding the botanical affinity of *Nageiopsis*, Professor Fontaine has repeatedly pointed out its striking resemblance to *Podocarpus*. While admitting this resemblance both Nathorst and Seward have suggested *Araucaria* for comparison.^b Although there is, for example, considerable similarity between *Nageiopsis zamioides* and *Araucaria bidwilli*, where in the genus *Araucaria* is there an analogue of *Nageiopsis longifolia*? In addition the *Araucariæ* have their leaves much crowded and the phyllotaxy is spiral while in *Nageiopsis* the leaves are much more remote and the evidence for a spiral phyllotaxy is not entirely conclusive although probable. *Araucaria* has markedly decurrent leaves and this character also can not be demonstrated

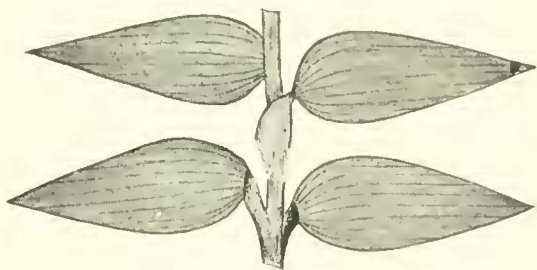


FIG. 1.—FRAGMENT OF A TWIG OF *NAGEIOPSIS ZAMIOIDES* SHOWING INDICATIONS OF DECURRENT LEAVES AND A SPIRAL PHYLLOTAXY. NATURAL SIZE, BUT SOMEWHAT EXAGGERATED.

^a Monogr. U. S. Geol. Surv., No. 48, 1906, pl. 117, figs. 4, 5.

^b This is probably the true affinity of Seward's Lower Oolite *Nageiopsis*. Jurassic Flora, pt. 1, 1900, p. 288, pl. 51.

for *Nageiopsis* although, as the writer shows elsewhere in this paper, there is some evidence for both this and the preceding character in some of the specimens. Taking into account all of the facts obtainable, however, the reference of *Nageiopsis* to the Podocarpeæ seems reasonably well established, at least the facts at our command do not warrant our making any changes at the present time although the possibility of *Nageiopsis* being related to the abundant Mesozoic Araucariæ should not be lost sight of.

The existing species of *Podocarpus* comprise about two score forms and they are as dominant representatives of the Coniferales in the Southern Hemisphere as are the pines in the Northern. They extend northward to China and Japan through the East Indian region and have representatives in all three of the great southern land masses. This peculiar distribution in itself may be considered as an indication of an extensive geological history, although the records of this history are not nearly as complete as they are for many other genera. To summarize briefly there are fifteen or more described species coming chiefly from the European Tertiary and one of these has been doubtfully recognized by Lesquereux in this country at Florissant, Colorado. The extra-American distribution includes Eocene species in England, Scotland, France, Italy, and Australia; Oligocene species in France, Germany, Switzerland, Italy, Styria, Tyrol, and Greece; Miocene species in France, Styria, and Croatia; and Pliocene species in Italy. The descendants of *Nageiopsis* have not, however, been recognized in later American deposits.

The comparison of *Nageiopsis* with *Podocarpus* is more especially with the section *Nageia*, one of the four sections into which Eichler^a divides *Podocarpus*. *Nageia*, formerly regarded as a distinct genus, has a broad form, numerous parallel veins, and lacks a midrib, the latter being present in the other three sections of the genus. It may be questioned whether the reduction of Gaertner's genus to a section of *Podocarpus* L'Herétier, as clearly expresses the natural facts as they would be emphasized by its retention as a distinct genus. *Nageia* has about a dozen species ranging from Japan southward to the East Indies and New Caledonia.

It has seemed wiser in considering detached and fragmentary leaves such as are those specimens which have been referred to *Nageiopsis* from the Shasta, Lakota, and Kootanie formations to fully indicate their extremely doubtful character. Likewise in regard to the affinity of some of the fragmentary detached specimens of *Nageiopsis*, so called, from higher horizons in the Potomac group in cases where there is absolutely no evidence that they are so related they have been referred to *Podozamites* or *Zamites*, genera broad enough to include them without the implications and the contravention of the generic diagnosis which would be involved in retaining them in *Nageiopsis*.

^a In Engler and Prantl.

NAGEIOPSIS LONGIFOLIA Fontaine.^a

Nageiopsis longifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 195, pl. 75, fig. 1; pl. 76, figs. 2-6; pl. 77, figs. 1, 2; pl. 78, figs. 1-5; pl. 79, fig. 7; pl. 85, figs. 1, 2, 8, 9.—? FONTAINE, in Diller and Stanton, Bull. Geol. Soc. Amer., vol. 5, 1894, p. 450.—? FONTAINE, in Stanton, Bull. 133, U. S. Geol. Surv., 1896, p. 15.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 259, 311, 484, 491, 510, 528, 548, 557; pl. 68, figs. 9-12; pl. 73, fig. 9 (not pl. 45, figs. 1-5).—? KNOWLTON, in Diller, Bull. Geol. Soc. Amer., vol. 19, 1908, p. 386.

Angiopteridium strictinerve FONTAINE ? in Diller and Stanton, Bull. Geol. Soc. Amer., vol. 5, 1894, p. 450.—FONTAINE, in Stanton, Bull. 133, U. S. Geol. Surv., 1896, p. 15.

Nageiopsis crassicaulis FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1899, p. 198, pl. 79, figs. 2, 6; pl. 82, fig. 1; pl. 84, figs. 3, 9, 11.

Description.—Branching leafy twigs of large size, stout and thick, apparently branched in approximately one plane. Leaves linear-lanceolate, often slightly curved, somewhat inequilaterally narrowed into a short slightly twisted petiole; above gradually narrowed to the acute or subacute tip. Length, 8 to 20 cm.; width, 5 mm. to 1.3 cm. The leaves are not crowded and usually appear opposite or subopposite, as if inserted on the lateral margins of the stem, although at times they seem to be attached to its upper or lower side. As previously remarked, none of the material is conclusive in regard to the phyllotaxy. Veins nine to twelve in number, usually ten, forking only at the base and running parallel until they abut against the leaf margin, about 0.7 mm. apart, somewhat coarser in caliber than in the other members of the genus, distinct on both surfaces of the lamina and apparently not immersed. Leaf substance not coriaceous.

This species is quite distinct from its congeners, and the great development of its evergreen foliage must have rendered it a most striking object in life.

Included under this species are the few and rather poor remains upon which Fontaine founded *Nageiopsis crassicaulis*. All but one of the specimens which that author so names are fragments of detached leaflets, somewhat shorter and broader than the typical leaves of *Nageiopsis longifolia*, but absolutely uncharacteristic and incapable of identification. The specimen with leaves attached is obviously a poorly preserved fragment of a twig of *Nageiopsis longifolia*.

This species occurs abundantly in characteristic and fine specimens at Fredericksburg. It has also been recorded from a large number

^a *Irites alaskana* Lesquereux is made a synonym of this species in Monograph 48. According to the principles so often set forth by Professor Ward, this species should be renamed if *Irites alaskana* is included in it, since the latter was published three years before *Nageiopsis longifolia*. As the Alaska remains are not those of a *Nageiopsis* this name is omitted from the synonymy.

of localities in Virginia and Maryland, mostly as detached specimens, generally with the base and apex missing, so that the record of its range is somewhat unreliable, nor can it be otherwise from the nature of the material. These doubtful occurrences are indicated by a query in the table of distribution.

Professor Fontaine has recorded this species from Cape Lisburne, Alaska; from several Californian localities referred to the Shasta group; from the Kootaine formation at Geyser, Montana, and from the Lakota formation in the Western Black Hills, at Barrett, Wyoming. Referring to these very briefly, it may be said that the Alaska locality is much older than any of the others, and the fossils referred to this species, previously identified by Lesquereux as *Irites alaskana* Lesquereux and *Baiera palmata* Heer, are entirely uncharacteristic, and, in the writer's judgment, are in nowise related to *Nageiopsis*. The Shasta records are based entirely on small fragments, which show only the middle portion of leaves and often lack the venation. The following quotation from Fontaine's report (1905, p. 259) sufficiently indicates their reliability: "The presence of *N. longifolia* in the flora of the Shasta formation can not be positively determined from the specimens found."

The Kootaine record is likewise extremely doubtful, and is based on five or six fragments from Geyser which are unattached and show neither bases nor tips. The specimens reported from the Lakota formation are also all fragmentary and uncharacteristic, and while we would expect to find this species in the west, the nature of the remains thus far collected scarcely justifies the identifications which have been based upon them, and as furnishing facts for stratigraphic correlation they are absolutely valueless.

Occurrence.—PATUXENT FORMATION. Dutch Gap, Kankeys, Cockpit Point, Telegraph station (Lorton), Virginia. ARUNDEL FORMATION. Langdon, District of Columbia. PATAPSCO FORMATION. Near Brooke, Mount Vernon, Deep Bottom (?), Chinkapin Hollow (?), Virginia; Fort Foote, Federal Hill, Vinegar Hill (?), Maryland. (?) LAKOTA FORMATION. Barrett, cliff on north side of valley of South Fork of Hay Creek, Wyoming. (?) KOOTAINÉ FORMATION. Geyser, Montana. (?) SHASTA FORMATION. Knoxville and Horsetown beds, Tehama County, California.

NAGEIOPSIS ANGUSTIFOLIA Fontaine.

Nageiopsis angustifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 202, pl. 86, figs. 8, 9; pl. 87, figs. 2-6; pl. 88, figs. 1, 3, 4, 6-8; pl. 89, fig. 2.—FONTAINE, in Ward, 19th Ann. Rept. U. S. Geol. Surv., pt. 2, 1899, p. 684, pl. 168, fig. 7.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 219, 491, 516, 528, 560, pl. 117, figs. 4, 5.

Description.—Much branched stems, of comparatively large caliber. Leaves variable in size, becoming smaller on ultimate twigs, but con-

stant in their proportions; very long and narrow, linear-lanceolate, sometimes somewhat falcate, acute, averaging about 3 mm. in width, in some instances only 1.5 mm. wide, greatest width observed 4 mm.; length 2 to 7 cm., averaging about 5 cm.; veins of fine caliber, generally eight in number, sometimes observed to fork at the base. An abundant species suggestive of *Cephalotaxopsis* in general appearance, but perfectly distinct and easily distinguished by the stomatal grooves of the latter.

Occurrence.—PATUXENT FORMATION. Fredericksburg, near Dutch Gap, near Potomac Run, Virginia; Sixteenth street, District of Columbia. ARUNDEL FORMATION. Bay View, Maryland. PATAPSCO FORMATION. Near Brooke, Mount Vernon, Virginia; Federal Hill, Fort Foote, Fort Washington (?), Maryland. (?) LAKOTA FORMATION. Barrett, Crook County, Wyoming. (?) SHASTA FORMATION.

NAGEIOPSIS ZAMIOIDES Fontaine.

Nageiopsis zamioides FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 196, pl. 79, figs. 1, 3; pl. 80, figs. 1, 2, 4; pl. 81, figs. 1-6.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 510, 521, 528, 545.

Nageiopsis recurvata FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 197, pl. 75, fig. 2; pl. 79, fig. 4; pl. 80, fig. 3.

Nageiopsis decrescens FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 199, pl. 77, fig. 3.

Nageiopsis ovata FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 199, pl. 77, fig. 4; pl. 80, fig. 5.

Nageiopsis heterophylla FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 201, pl. 84, fig. 4; pl. 86, figs. 6, 7; pl. 88, figs. 2, 5.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 219 (?), 483, 520, 548, 561, pl. 117, fig. 6.

Nageiopsis microphylla FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 201, pl. 84, fig. 6; pl. 85, fig. 14; pl. 86, figs. 1-3, 5.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 484.

Nageiopsis cf. *N. heterophylla* FONTAINE, Seward, Wealden Flora, pt. 2, 1895, p. 211, pl. 12, fig. 3.

Description.—Leaves ovate-lanceolate, proportionately shorter and wider than in *N. angustifolia* and much shorter and more rounded in outline than in *N. longifolia*, broadest toward the rounded base, the maximum width observed being 1.5 cm., although the average width is much less and may be put at 1 cm. or slightly less; very variable in size, tip generally acute, although an occasional specimen may be obtuse. The greatest length observed is 8 cm., but the average length is much less than this, and may be placed at 3 cm. to 4 cm. Occasional twigs like the solitary specimen described as *N. decrescens* or the specimens referred to *N. microphylla* may be much smaller than the above; the latter are, however, of the same general shape, while in the former case the fact that the larger leaves at the base of the specimen are replaced by very minute leaves indicates that the specimen is an abnormal twig. Veins fine in caliber, somewhat remote, generally six to nine in number, forking at the base

and diverging rapidly at first, then parallel until they abut upon the margin.

While it might seem at first sight that too great a variety of leaf forms had been lumped under this specific name, the great variability of the leaves on single twigs should be kept in mind. The leaves in the type forms are commonly smallest toward the base of the twigs, as they are also in the *N. ovata* forms. In *N. decrescens* the basal leaves are one hundred per cent longer than are the succeeding leaves. In the forms described by Fontaine as *N. heterophylla* the leaves are especially variable, some being identical with those he called *N. microphylla*, while others are like those he calls *N. decrescens*, others still simulating his *N. ovata* and *N. zamioides* with two or more of these types present on the same twigs. Others referred by him to *N. zamioides* show an equally wide range of variation. I have figured (fig. 2) a specimen labeled *N. zamioides* which shows but five leaves,



FIG. 2. TWIG OF NAGELOPSIS ZAMIOIDES SHOWING VARIATION IN FORM AND SIZE OF LEAVES.

and includes leaves easily referable to his species *microphylla*, *decrescens*, *ovata*, *heterophylla*, and *zamioides*, leaving only his *N. recurvata* to be accounted for. Since these latter are detached, there is really no proof that they are correctly identified. They are, however, exactly like certain somewhat falcate leaves of *N. zamioides* found on twigs among normally straight leaves, so that there is little doubt but that the Virginia specimens are referable to this species. The form identified as *N. recurvata* from Vinegar Hill, Maryland, is different from the others and is a *Podozamites* leaflet. Corroborate

evidence is furnished by the similarity in venation characters and in the fact that all but one of the six so-called species, *N. decrescens*, are from the single limited exposure at Fredericksburg, and this was described from a near-by and probably synchronous outcrop and is really present at Fredericksburg attached to a twig labeled *N. heterophylla*. Four of them are again associated at the Dutch Gap locality. Again at Fredericksburg the typical *zamioides* of Fontaine are very abundant, while the variants which he described as separate species are represented in some cases by a single specimen, in others by but two or three specimens. I think a glance at the various figures in Fontaine's monograph and a perusal of the accompanying descriptions will be convincing, and this is only emphasized by a consultation of the specimens themselves.

Compare, for example, fig. 5 of *ovata* with fig. 3 of *zamioides* and it will be seen that they might have been drawn from the same specimens. This is likewise true when the single specimen of *N. decrescens* is

compared with fig. 3 and fig. 6 of *N. microphylla*, and similar comparisons can be made back and forth indefinitely.

Seward^a describes and figures a few small fragments from the English Wealden at Hastings and Ecclesbourne, which he compares with *N. heterophylla* Fontaine. The specimen figured shows well the branching habit, and as near as can be judged, is a species of *Nagciopsis*. Since, however, the name *N. heterophylla* Fontaine becomes a synonym of *N. zamioides* Fontaine, the English fossils may be given the latter name without question, it seems to me.

Occurrence.—PATUXENT FORMATION. Fredericksburg, Dutch Gap, Cockpit Point, near Potomac Run, Virginia. ARUNDEL FORMATION. Langdon, District of Columbia; Bay View, Hobb's Iron Mine (?), Maryland. PATAPSCO FORMATION. Vinegar Hill, Overlook Inn Road, Maryland. (?) SHASTA FORMATION. Tehama County, California.

It remains to notice several forms described as species of *Nagciopsis* and which are obviously not related to that genus. The first to be considered is *Nagciopsis acuminata* Fontaine, founded on a single detached leaf from near Telegraph Station, Virginia. Professor Fontaine's figure is quite accurate in outline and the veins are very distinct although he says "veins not seen;" they number about twenty and are thus more numerous than in *Nagciopsis*, besides being coarser and more distinctly immersed. This leaf appears to be identical with the leaflets of *Podozamites acutifolius* of the same author, some specimens of which have been found at this same locality.

Another form, named *N. subfalcata* by Professor Fontaine, is also based on a single imperfect specimen which came from near Dutch Gap, Virginia. As figured and described it presents no characters by which it can be recognized and none which ally it with *Nagciopsis*. The writer has been unable to locate this specimen in the National Museum collections. Professor Fontaine says of it: "Its position is doubtful, and it may be a *Sequoia*, for the footstalks seem to be decurrent. They leave imprints on the stem resembling those of *Sequoia*." It is extremely probable that this specimen should be referred to *Sequoia*, as Fontaine suggests.

^a Wealden Flora, pl. 2, 1895, p. 211, pl. 12, fig. 3.

PODOZAMITES INÆQUILATERALIS (Fontaine), new combination.

Nageiopsis obtusifolia FONTAINE,^a Monogr. U. S. Geol. Surv., No. 15, 1890, p. 200, pl. 85, fig. 7.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1906, p. 484.

Nageiopsis inæquilateralis FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 200, pl. 85, fig. 6.

Nageiopsis montanensis FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1906, p. 312, pl. 73, fig. 7.

The description of *N. inæquilateralis* is an alliteration of that of the preceding *N. obtusifolia*. It is based on a single specimen. Veins are twenty-two in number, much thicker than in *Nageiopsis* and like those in *N. acuminata*, which has already been referred to *Podozamites*. They converge toward the tip of the leaf, which is missing in the specimen. Leaf pedicellate at base.

N. montanensis, from the Kootanie at Geyser, Montana, is based on a single detached leaflet with nineteen or twenty veins, convergent in the obtuse tip. There is absolutely no ground for including it in *Nageiopsis*. The *inæquilateralis* specimen comes from Kankeys, Virginia, and *obtusifolia* was found near Potomac Run and at Cockpit Point, Virginia.

These imperfect forms are suggestive of *Podozamites affinis* (Schenk) Schimper of the Wernsdorfer schichten, but are not representative enough for accurate comparison.

Occurrence.—PATUXENT FORMATION. Kankeys, Cockpit Point, near Potomac Run, Virginia. KOOTANIE FORMATION. Geyser, Montana.

PHYLLITES LATIFOLIUS (Fontaine), new combination.

Nageiopsis latifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 198, pl. 82, fig. 3.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1906, p. 260, pl. 68, fig. 13.

Description.—"Leaves very broad and short, base and apex not seen; leaf-substance thin; shape of leaves probably broadly elliptical; nerves not fully disclosed, but probably branching near the base; they are then approximately parallel to near the apex, following the margins, and parallel." Fontaine, 1890.

This species was based on several detached leaves, from near Dutch Gap Canal and Potomac Run, none of which show base, apex, general form, or method of attachment, the most complete one found being the one figured. They present no characters which ally them to *Nageiopsis*, from which they are excluded by their deciduous nature. The single specimen which Fontaine identifies as this species from

^aThe specific name *obtusifolia* can not be used for a species of *Podozamites*, as there has been quasi use of this combination by Heer: Handl. Königl. Sven. Vet. Akad. (Fl. Foss. Arct., vol. 4, pt. 1), 1876, p. 39, pl. 8, fig. 6.

the Shasta is equally unsatisfactory, and judging by the analogies furnished by the existing Podocarpeae it seems extremely unlikely that conifers of the *Nageiopsis* type should have included such broad-leaved forms.

They are possibly referable to some of the large-leaved Cycadaceae of the Lower Cretaceous, Professor Fontaine suggesting their possible reference to *Podozamites* (cf. *grandifolius* Fontaine). They may also be compared to conifers of the *Dammara* type, but the material collected up to the present time is incapable of throwing any light on their true botanical affinity.

Occurrence.—PATUXENT FORMATION. Near Dutch Gap, near Potomac Run, Virginia. (?)SHASTA FORMATION. Near Riddles, Oregon.